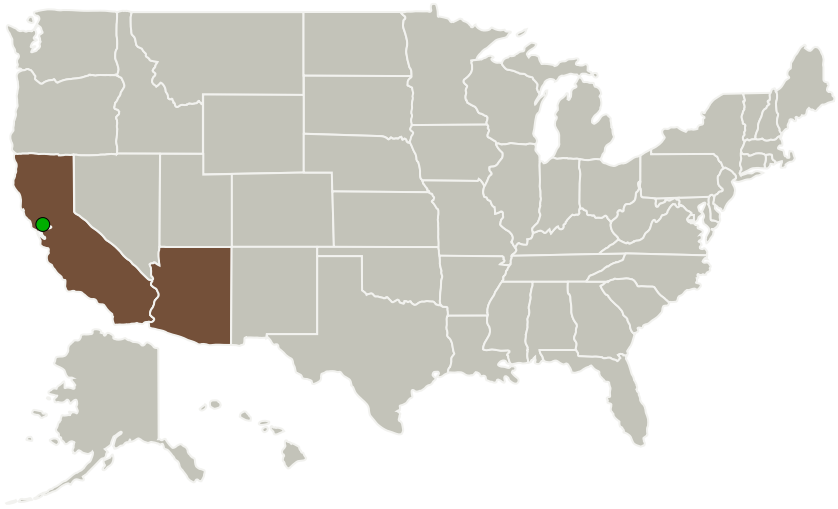
CFD-Based Over-Determined Trim Analysis for Optimum Aerodynamic Efficiency, Phase I

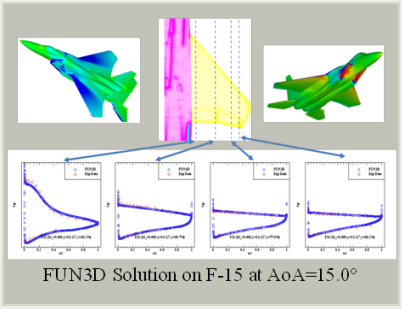
Completed Technology Project (2014 - 2014)

Project Introduction

The overall objective of this Phase I project is to develop a nonlinear trim module in FUN3D for enabling the determined and over-determined trim analyses to be performed by FUN3D with static aeroelastic effects. Based on an optimization formulation, the over-determined trim analysis can determine the optimum control surface scheduling of multiple control surfaces to achieve the best aerodynamic efficiency of the aircraft using the high-fidelity Navier-Stokes (N-S) solver in FUN3D. At the critical loads flight conditions, the optimum control surface scheduling can minimize the design loads; leading to a lighter and more flexible structural design. At the cruise conditions, the optimum control surface scheduling can aeroelastically deform the more flexible structure to an optimum shape for induced drag minimization at cruise. One non-conventional design concept under investigation by NASA is the Variable Camber Continuous Trailing Edge Flap (VCCTEF) system that utilizes multiple advanced actuators such as shape memory alloys (SMA) to achieve an optimum continuous deformed wing shape for obtaining the best aerodynamic efficiency. The VCCTEF design concept for the aerodynamic efficiency improvement will be ultimately verified by wind tunnel testing. However, such a wind tunnel testing will be impractically without a viable wind tunnel test plan that can provide a guideline for seeking the optimum actuation scheduling in the multi-dimensional design space. This viable wind tunnel test plan for testing the VCCTEF concept can be established by the FUN3D nonlinear trim module.

Primary U.S. Work Locations and Key Partners





CFD-Based Over-Determined Trim Analysis for Optimum Aerodynamic Efficiency Project Image

Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

CFD-Based Over-Determined Trim Analysis for Optimum Aerodynamic Efficiency, Phase I

Completed Technology Project (2014 - 2014)

Organizations Performing Work	Role	Type	Location
ZONA Technology, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Scottsdale, Arizona
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
Arizona	California

Project Transitions

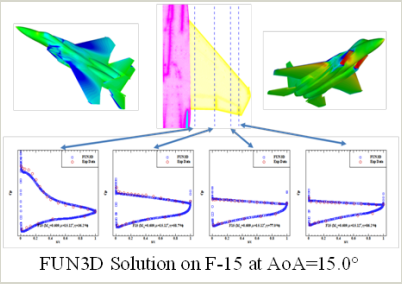
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137526)*

Images



Project Image
CFD-Based Over-Determined Trim Analysis for Optimum Aerodynamic Efficiency Project Image *(https://techport.nasa.gov/image/130158)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
ZONA Technology, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

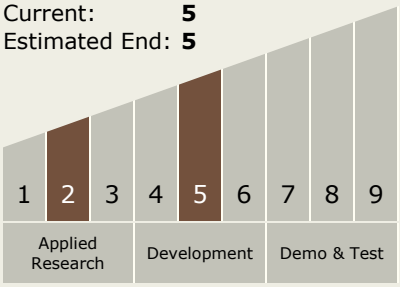
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Ping-chih Chen

Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**



CFD-Based Over-Determined Trim Analysis for Optimum Aerodynamic Efficiency, Phase I

Completed Technology Project (2014 - 2014)

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.3 Aeroelasticity

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System